

CLAIMS

What is claimed is:

1. A copper characterized by the x-ray fluorescence spectrometry plot of Figure 6A, 6B, 7, 25, or 26.
- 5 2. A nickel characterized by the x-ray fluorescence spectrometry plot of Figures 27A, 27B, 28A, 28B, 29, or 30.
3. A cobalt characterized by the x-ray fluorescence spectrometry plot of Figures 31A, 31B, 32A, 32B, 33A, 33B, or 34.
- 10 4. A silicon characterized by the x-ray fluorescence spectrometry plot of Figures 45A, 45B, 46A, 46B, 47A, 47B, 48A, or 48B.
5. An iron characterized by the x-ray fluorescence spectrometry plot of Figures 49A, 49B, 50A, 50B, 51A, or 51B.
- 15 6. A method of processing a metal or an alloy of metals, comprising the steps of:
 - (A.) adding the metal or alloy to a reactor in or more steps and melting said metal or alloy;
 - (B.) adding a carbon source to the molten metal or alloy and dissolving carbon in said molten metal or alloy, followed by removing the undissolved carbon source;
 - (C.) increasing the temperature of the molten metal or alloy;
 - 20 (D.) varying the temperature of the molten metal or alloy between two temperatures over one or more cycles;
 - (E.) adding a flow of an inert gas through the molten metal or alloy;

- (F.) varying the temperature of the molten metal or alloy between two temperatures over one or more cycles;
- (G.) adding a carbon source to the molten metal or alloy and dissolving carbon in said molten metal or alloy, followed by removing the undissolved carbon source;
- 5 (H.) varying the temperature of the molten metal or alloy between two temperatures over one or more cycles, wherein the molten metal or alloy has a greater degree of saturation with carbon than in Step (F.);
- (I.) stopping the flow of the inert gas;
- 10 (J.) varying the temperature of the molten metal or alloy between two temperatures over one or more cycles, wherein the molten metal or alloy has a greater degree of saturation with carbon than in Step (H.) and wherein an inert gas is added as the temperature is lowered and an inert gas, chosen independently, is added as the temperature is raised;
- 15 (K.) varying the temperature of the molten metal or alloy between two temperatures over one or more cycles, wherein the molten metal or alloy has a greater degree of saturation with carbon than in Step (J.) and wherein an inert gas is added as the temperature is lowered and an inert gas, chosen independently, is added as the temperature is raised;
- 20 (L.) stopping the flow of the inert gases;
- (M.) varying the temperature of the molten metal or alloy between two temperatures over one or more cycles, wherein the molten metal or alloy has an equal or greater degree of saturation with carbon than in Step (K.); and
- 25 (N.) cooling the molten metal or alloy to room temperature, thereby obtaining a solidified manufactured metal or alloy.
7. A method of processing a metal or an alloy of metals, comprising the steps of:
- (A.) adding the metal or alloy to a reactor in one or more steps and melting said metal or alloy;

- (B.) adding a carbon source to the molten metal or alloy and dissolving carbon in said molten metal or alloy, followed by removing the undissolved carbon source;
- (C.) varying the temperature of the molten metal or alloy between two temperatures over two or more cycles;
- (D.) adding a carbon source to the molten metal or alloy and further dissolving carbon in said molten metal or alloy, followed by removing the undissolved carbon source;
- (E.) varying the temperature of the molten metal or alloy between two temperatures over two or more cycles, wherein the molten metal or alloy has a greater degree of saturation with carbon than in Step (D.); and
- (F.) cooling the molten metal or alloy to room temperature, thereby obtaining a solidified manufactured metal or alloy;
- further characterized by adding a flow of inert gas before, during, or after Steps (B.) through (E.).
8. The method of Claim 6, wherein the metal is a transition metal.
9. The method of Claim 8, wherein the transition metal is chromium, manganese, iron, cobalt, nickel, copper, zinc, or alloys thereof.
10. The method of Claim 6, wherein the metal is an alkali metal or an alkaline earth metal.
11. The method of Claim 6, wherein the metal is silicon.
12. The method of Claim 6, wherein the metal is aluminum.
13. The method of Claim 7, wherein the metal is a transition metal.

14. The method of Claim 13, wherein the transition metal is chromium, manganese, iron, cobalt, nickel, copper, zinc, or alloys thereof.
15. The method of Claim 7, wherein the metal is an alkali metal or an alkaline earth metal.
- 5 16. The method of Claim 7, wherein the metal is silicon.
17. The method of Claim 7, wherein the metal is aluminum.
18. The method of Claim 6, wherein the alloy of metals comprises copper, gold, and silver.
- 10 19. The method of Claim 6, wherein the alloy of metals comprises tin, zinc, and lead.
20. The method of Claim 6, wherein the alloy of metals comprises tin, sodium, magnesium, and potassium.
21. The method of Claim 6, wherein the alloy of metals comprises iron, vanadium, chromium, and manganese.
- 15 22. The method of Claim 6, wherein the alloy of metals comprises nickel, tantalum, hafnium, and tungsten.
23. The method of Claim 6, wherein the carbon source of Steps (B.) and (G.), independently, is a graphite rod, graphite powder, graphite flakes, diamond, fullerenes, natural gas, methane, ethane, propane, butane, pentane, cast iron, iron comprising carbon, or steel comprising carbon.
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24. The method of Claim 6, wherein each cycle of Steps (D.), (F.), (H.), (J.), (K.), and (L.) comprises, in any order, a period of increasing metal or alloy temperature and a period of decreasing metal or alloy temperature and wherein a cycle has a duration of 3 to 67 minutes.
- 5 25. The method of Claim 24, wherein each cycle of Steps (D.), (F.), (H.), (J.), (K.), and (L.) comprises, in any order, a period of increasing metal or alloy temperature and a period of decreasing metal or alloy temperature and wherein a cycle has a duration of 8 to 30 minutes.
- 10 26. The method of Claim 6, wherein the period of increasing metal or alloy temperature in Steps (D.), (F.), (H.), (J.), (K.), and/or (L.), independently, is different than the period of decreasing metal or alloy temperature.
27. The method of Claim 6, wherein the period of increasing metal or alloy temperature in Steps (D.), (F.), (H.), (J.), (K.), and/or (L.), independently, is equal to the period of decreasing metal or alloy temperature.
- 15 28. The method of Claim 6, wherein the inert gas of Steps (E.), (J.), and (K.), independently, is argon, nitrogen, helium, neon, xenon, hydrogen, krypton, and mixtures thereof.
- 20 29. The method of Claim 6, wherein the molten metal or alloy of Step (N.) is cooled to room temperature by heat exchange with inert gas over 1 to 72 hours.
- 25 30. The method of Claim 6, wherein the molten metal or alloy of Step (N.) is cooled to room temperature by quenching in a bath comprising tap water, distilled water, deionized water, other forms of water, inert gases, liquid nitrogen or other suitable liquified gases, a thermally-stable oil or organic coolant, and combinations thereof.

31. The method of Claim 6, wherein the reactor is an induction furnace.
32. A method of processing copper, comprising the steps of:
- (A.) adding copper to a reactor in one or more steps and melting copper;
 - (B.) adding a carbon source to the molten copper and dissolving carbon in
5 the molten copper, followed by removing the undissolved carbon source;
 - (C.) increasing the temperature of the copper;
 - (D.) varying the temperature of the molten copper between two temperatures over 15 cycles;
 - 10 (E.) adding a flow of an inert gas through the molten copper;
 - (F.) varying the temperature of the molten copper between two temperatures over 5 cycles;
 - (G.) adding a carbon source to the molten copper and dissolving carbon in
15 the molten copper, followed by removing the undissolved carbon source;
 - (H.) varying the temperature of the molten copper between two temperatures over 20 cycles;
 - (I.) stopping the flow of the inert gas;
 - (J.) varying the temperature of the molten copper between two
20 temperatures over 4.5 cycles, wherein an inert gas is added as the temperature is lowered and an inert gas, chosen independently, is added as the temperature is raised;
 - (K.) varying the temperature of the molten copper between two
25 temperatures over 15.5 cycles, wherein an inert gas is added as the temperature is lowered and an inert gas, chosen independently, is added as the temperature is raised;
 - (L.) stopping the flow of the inert gases;
 - (M.) varying the temperature of the molten copper between two temperatures over 1 cycle; and
 - 30 (N.) cooling the molten copper to room temperature, thereby obtaining a solidified manufactured copper.

33. A method of processing copper, comprising:
- (1.) contacting molten copper with a carbon source;
 - (2.) an iterative cycling process, wherein relative saturation of copper with carbon remains the same or increases independently with each cycle;
 - 5 and
 - (3.) cooling the molten copper to room temperature, thereby obtaining a solidified manufactured copper.
34. An alloy comprised of copper, gold, and silver characterized by the x-ray fluorescence spectrometry plot of Figure 35, 36, or 37.
- 10 35. An alloy comprised of tin, lead, and zinc characterized by the x-ray fluorescence spectrometry plot of Figure 38, 39, or 40.
36. An alloy comprised of tin, sodium, magnesium, and potassium characterized by the x-ray fluorescence spectrometry plot of Figure 41, 42, 43, or 44.
- 15 37. An alloy comprised of iron, vanadium, chromium, and manganese characterized by the x-ray fluorescence spectrometry plot of Figure 52, 53, 54, or 55.
38. An alloy comprised of nickel, tantalum, hafnium, and tungsten characterized by the x-ray fluorescence spectrometry plot of Figure 56, 57, 58, 59, 60, or 61.
- 20 39. A copper characterized by the x-ray fluorescence spectrometry plot of Figure 25.
40. A nickel characterized by the x-ray fluorescence spectrometry plot of Figures 27A or 27B
41. A cobalt characterized by the x-ray fluorescence spectrometry plot of Figures 31A or 31B.

42. A silicon characterized by the x-ray fluorescence spectrometry plot of Figures 45A or 45B.
43. An iron characterized by the x-ray fluorescence spectrometry plot of Figures 49A or 49B.